



**PATENT**  
**Atty. Dkt. No. APPM/5351.Y1/CP/L/B/PJS**

In re Application of:  
Mak et al.

Patent No.: 6,849,545

Issued: February 1, 2005

Serial No.: 09/885,609

Filed: June 20, 2001

For: SYSTEM AND METHOD TO  
FORM A COMPOSITE FILM  
STACK UTILIZING  
SEQUENTIAL DEPOSITION  
TECHNIQUES

www.pearsoned.com

Group Art Unit: 2818

Examiner: Renee R. Berry

**Certificate**  
SEP 13 2006  
**of Correction**

Certificate of Correction Branch  
Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

CERTIFICATE OF MAILING  
37 CFR 1.8

I hereby certify that this correspondence is being deposited on 9/7, 2006 with the United States Postal Service as First Class Mail in an envelope addressed to: Certificate of Correction Branch, Commissioner for Patents, P.O. Box 1450 Alexandria, VA 22313-1450.

9/7/06 *Kim R. [Signature]*  
Date Signature

Dear Sir:

## REQUEST FOR CORRECTED PATENT

Attached is a certificate of correction for correcting several errors throughout the printed patent. However, because of the nature of the errors, applicants request that the Director issue a corrected patent, if appropriate, in lieu of the certificate of correction (MPEP §1480; 35 USC 254 and 37 CFR 1.322(b)).

Some of the missing references were cited by the Applicant in an Information Disclosure Statement filed on March 29, 2002. It appears that these references were lost, and thus they do not appear on the printed patent. Attached is a copy of the PTO-1449 as originally submitted on March 29, 2002, as well as a copy of the stamped return receipt postcard showing evidence that the Patent Office acknowledged receipt of this Information Disclosure Statement.

Some of the missing references were cited by the Applicant in an Information Disclosure Statement filed on May 2, 2002. It appears that these references were

SEP 13 2006

SEP 13 2003

lost, and thus they do not appear on the printed patent. Attached is a copy of the PTO-1449 as originally submitted on May 2, 2002, as well as a copy of the stamped return receipt postcard showing evidence that the Patent Office acknowledged receipt of this Information Disclosure Statement.

The missing reference US-2003/0089308 was initialed by the examiner on July 10, 2004 in the Notice of Allowability dated August 2, 2004. Attached is a copy of the PTO/SB/08a showing the missing reference initialed by the examiner.

The remaining missing references were cited by the examiner in the Office Action dated March 14, 2003. Attached is a copy of the PTO-892 showing the missing references.

The drawings that appear in the printed patent are the informal drawings. Formal drawings were submitted on November 27, 2001, which appear to have been lost or overlooked. Attached is a copy of the transmittal form, transmittal letter, and formal drawings as submitted on November 27, 2001, as well as a copy of the stamped return receipt postcard showing evidence that the Patent Office acknowledged receipt of the drawings.

Applicants submit that the errors mentioned above were not made by the applicants, but were made during the printing of the patent. Accordingly, the Applicants believe that no fee is due for the corrected patent at this time.

Respectfully submitted,



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## UNITED STATES PATENT AND TRADEMARK OFFICE

### CERTIFICATE OF CORRECTION

PATENT NO. : 6,849,545

Page 1 of 18

APPLICATION NO. : 09/885,609

DATED : Feb. 1, 2005

INVENTOR(S) : Alfred W. MAK, Mei CHANG, Jeong Soo BYUN, Hua CHUNG, Ashok SINHA, Moris KORI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

#### On the Cover of the Patent

Item [56], References Cited, U.S. PATENT DOCUMENTS: Please include the following references:

4,486,487	12/1984	Sarp .....	428/216
4,829,022	5/1989	Kobayashi et al. ....	437/107
4,834,831	5/1989	Nishizawa et al. ....	156/611
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Item [56], References Cited, FOREIGN PATENT DOCUMENTS: Please include the following references:

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04-212411	08/04/1992	JP	H01L	21/203
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# UNITED STATES PATENT AND TRADEMARK OFFICE

## CERTIFICATE OF CORRECTION

PATENT NO. : 6,849,545

Page 7 of 18

APPLICATION NO. : 09/885,609

DATED : Feb. 1, 2005

INVENTOR(S) : Alfred W. MAK, Mei CHANG, Jeong Soo BYUN, Hua CHUNG, Ashok SINHA, Moris KORI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

04-273120	09/29/1992	JP	H01L	21/20
04-285167	10/09/1992	JP	C23C	14/54
04-291916	10/16/1992	JP	H01L	21/205
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05-074717	03/26/1993	JP	H01L	21/205
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05-102189	04/23/1993	JP	H01L	21/336
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05-175143	07/13/1993	JP	H01L	21/205
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05-343327	12/24/1993	JP	H01L	21/205
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SEP 13 2005

# UNITED STATES PATENT AND TRADEMARK OFFICE

## CERTIFICATE OF CORRECTION

PATENT NO. : 6,849,545

Page 8 of 18

APPLICATION NO. : 09/885,609

DATED : Feb. 1, 2005

INVENTOR(S) : Alfred W. MAK, Mei CHANG, Jeong Soo BYUN, Hua CHUNG, Ashok SINHA, Moris KORI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

09-260786	10/03/1997	JP	H01S	3/18
09-293681	11/11/1997	JP	H01L	21/205
10-188840	07/21/1998	JP	H01J	29/18
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10-308283	11/17/1998	JP	H05B	33/22
11-269652	10/05/1999	JP	C23C	16/44
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2000-087029	03/28/2000	JP	C09K	11/08
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## UNITED STATES PATENT AND TRADEMARK OFFICE CERTIFICATE OF CORRECTION

PATENT NO. : 6,849,545

Page 9 of 18

APPLICATION NO. : 09/885,609

DATED : Feb. 1, 2005

INVENTOR(S) : Alfred W. MAK, Mei CHANG, Jeong Soo BYUN, Hua CHUNG, Ashok SINHA, Moris KORI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Item [56], References Cited, OTHER PUBLICATIONS: Please include the following references:

Hultman, et al., "Review of the thermal and mechanical stability of TiN-based thin films", Zeitschrift Fur Metallkunde, 90(10) (Oct. 1999), pp. 803-813.

Klaus, et al., "Atomic Layer Deposition of SiO<sub>2</sub> Using Catalyzed and Uncatalyzed Self-Limiting Surface Reactions", Surface Review & Letters, 6(3&4) (1999), pp. 435-448.

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Wise, et al., "Diethyldiethoxysilane as a new precursor for SiO<sub>2</sub> growth on silicon", Mat. Res. Soc. Symp. Proc., Vol. 334 (1994), pp. 37-43.

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Klaus, et al., "Atomic Layer Deposition of Tungsten using Sequential Surface Chemistry with a Sacrificial Stripping Reaction", Thin Solid Films 360 (2000), Pages 145 - 153, (Accepted Nov. 16, 1999).

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Martensson, et al., "Atomic Layer Epitaxy of Copper on Tantalum", Chemical Vapor Deposition, 3(1) (Feb. 1, 1997), pp. 45-50.

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## UNITED STATES PATENT AND TRADEMARK OFFICE

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PATENT NO. : 6,849,545

Page 10 of 18

APPLICATION NO. : 09/885,609

DATED : Feb. 1, 2005

INVENTOR(S) : Alfred W. MAK, Mei CHANG, Jeong Soo BYUN, Hua CHUNG, Ashok SINHA, Moris KORI

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Ritala, et al. "Atomic Layer Epitaxy Growth of TiN Thin Films", J. Electrochem. Soc., 142(8) (Aug. 1995), pp. 2731-737.

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Ohba, et al., "Thermal Decomposition of Methylhydrazine and Deposition Properties of CVD TiN Thin Films", Conference Proceedings, Advanced Metallization for ULSI Applications in 1993 (1994), pp. 143-149

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Suzuki, et al., "A 0.2- $\mu$ m contact filling by 450°C-hydrazine-reduced TiN film with low resistivity", IEDM 92-979, pp. 11.8.1 – 11.8.3

Suzuki, et al., "LPCVD-TiN Using Hydrazine and TiCl4", VMIC Conference (June 8-9, 1993), pp. 418-423

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Page 11 of 18

APPLICATION NO. : 09/885,609

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It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

McGeachin, S., "Synthesis and properties of some  $\beta$ -diketimines derived from acetylacetone, and their metal complexes", Canadian J. of Chemistry, Vol. 46 (1968), pp.1903-1912

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NERAC Search abstract of "Atomic Layer deposition of Ta and Ti for Interconnect Diffusion Barriers", by Rosnagel, et al., J. Vac. Sci. & Tech., 18(4) (July 2000)

Abstracts of articles re atomic layer deposition

Abstracts of search results re atomic layer deposition, search dated January 24, 2002

Abstracts of articles re atomic layer deposition and atomic layer nucleation

Abstracts of articles re atomic layer deposition and semiconductors and copper

Abstracts of articles – atomic layer deposition

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Bader, et al., "Integrated Processing Equipment", Solid State Technology, Cowan Pub., Vol. 33, No. 5 (May 1, 1990), pp. 149-154

Choi, et al., "The effect of annealing on resistivity of low pressure chemical vapor deposited titanium diboride", J. Appl. Phys. 69(11) (June 1, 1991), pp. 7853-7861

Choi, et al., "Stability of TiB<sub>2</sub> as a Diffusion Barrier on Silicon", J. Electrochem. Soc. 138(10) (October 1991), pp. 3062-3067

"Cluster Tools for Fabrication of Advanced devices" Jap. J. of Applied Physics, Extended Abstracts, 22nd Conference Solid State Devices and Materials (1990), pp. 849 – 852 XP000178141

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"Applications of Integrated processing", Solid State Technology, US, Cowan Pub., Vol 37, No. 12 (December 1, 1994), pp. 45-47

Kitigawa, et al., "Hydrogen-mediated low temperature epitaxy of Si in plasma-enhanced chemical vapor deposition", Applied Surface Science (2000), pp. 30-34

Lee, et al., "Pulsed nucleation for ultra-high aspect ratio tungsten plugfill", Novellus Systems, Inc. (2001), pp. 1-2.

### In the Drawings

Replace all of the drawings (FIGS. 1-10, sheets 1-6) with the formal drawings (FIGS. 1-10, sheets 1-6), copies attached.

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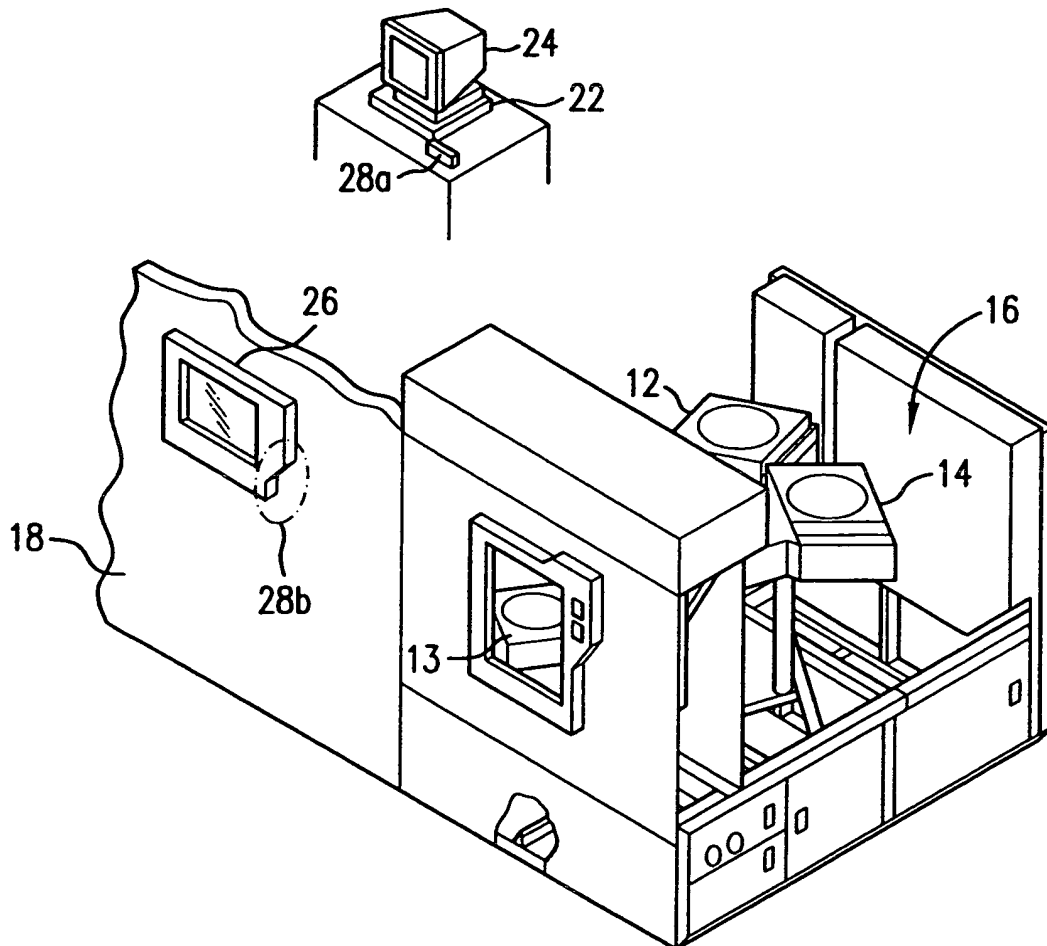


FIG. 1

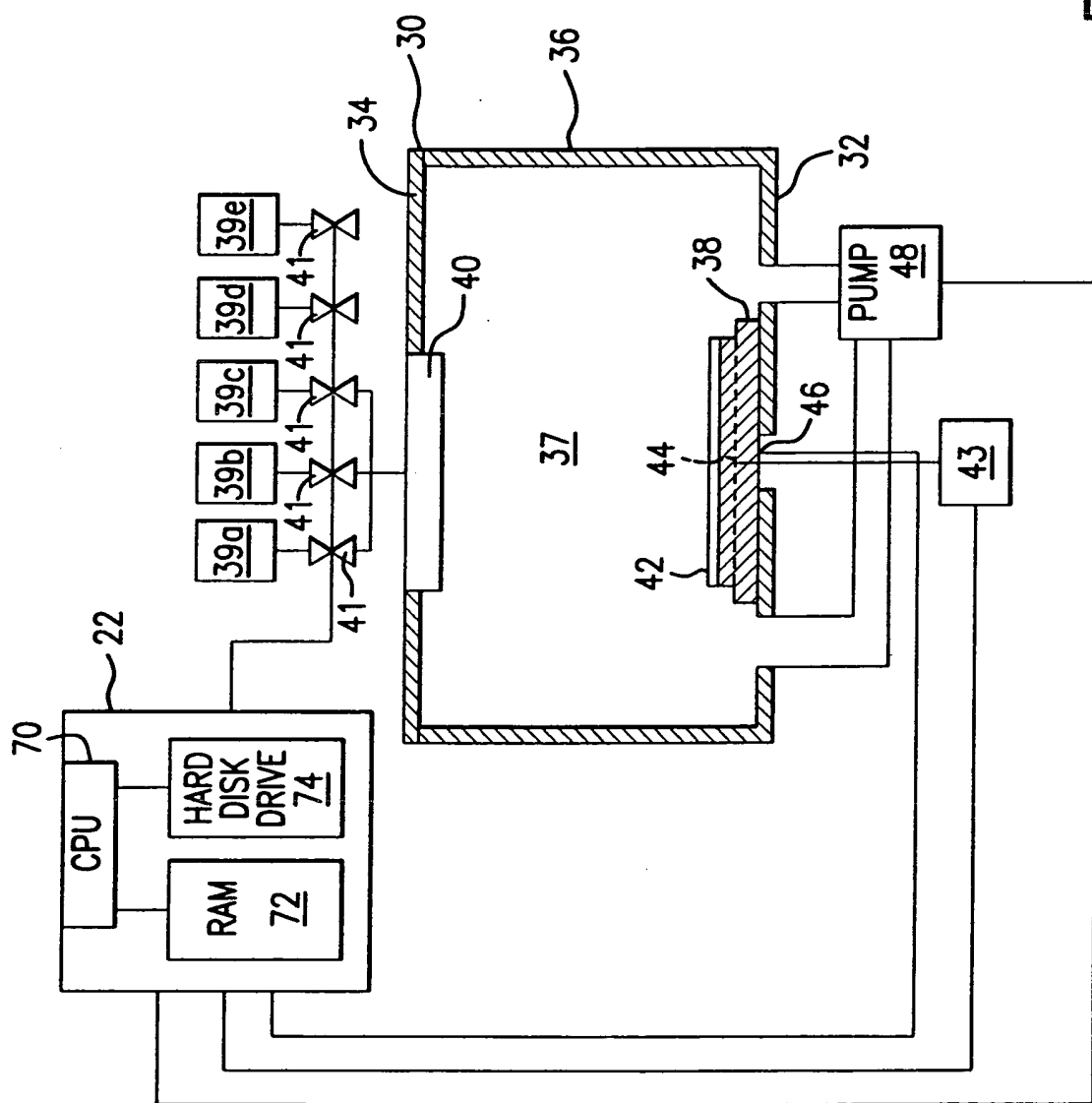


FIG. 2



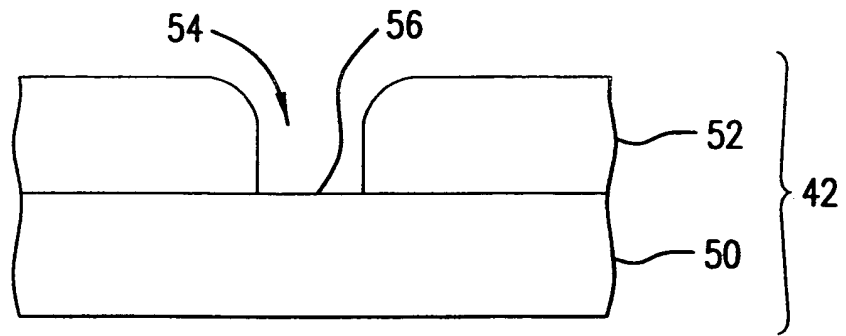


FIG. 3

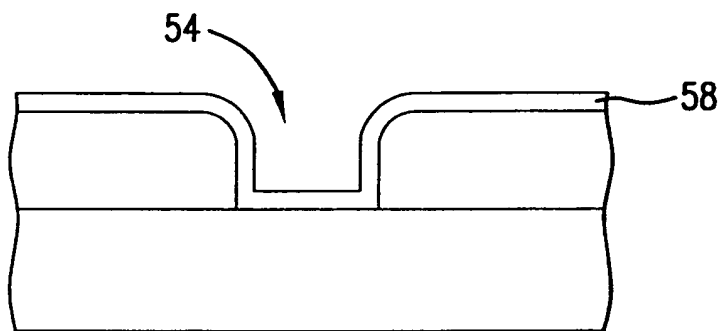


FIG. 4

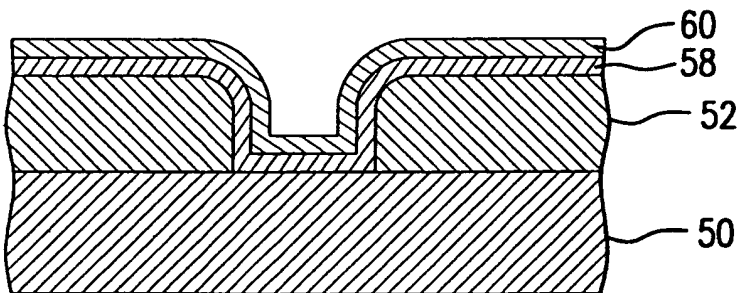


FIG. 5

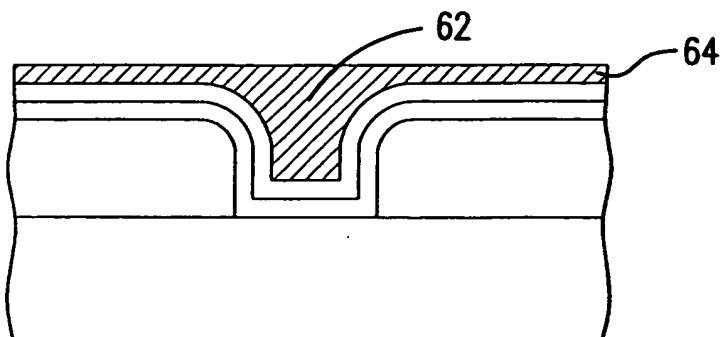


FIG. 6

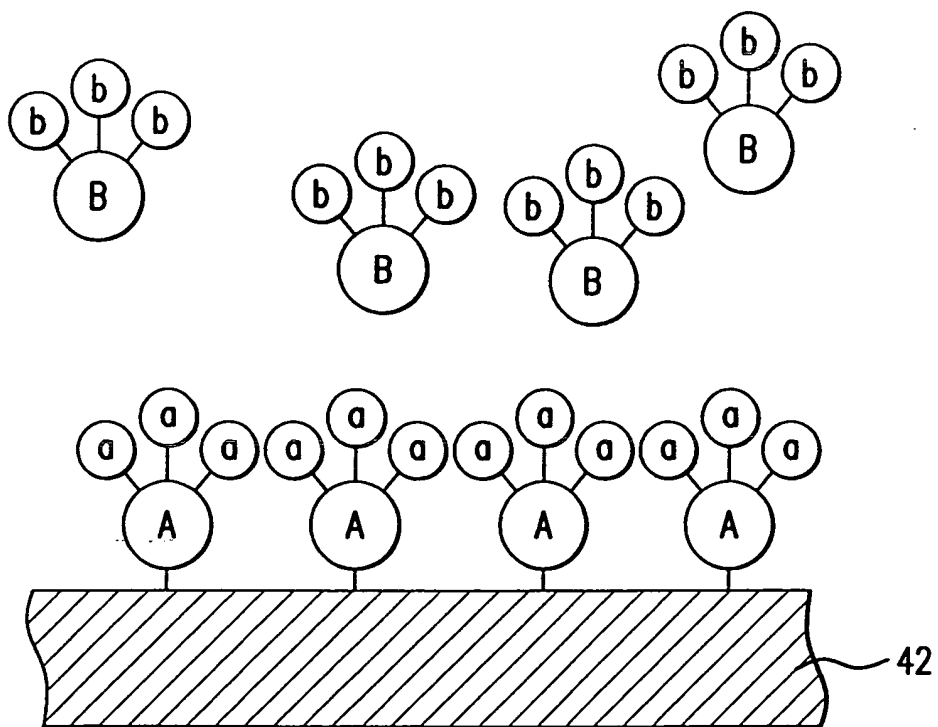


FIG. 7

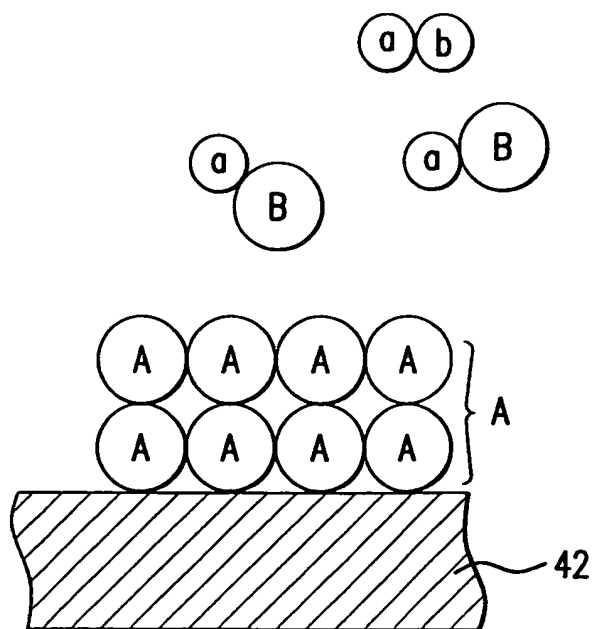


FIG. 8

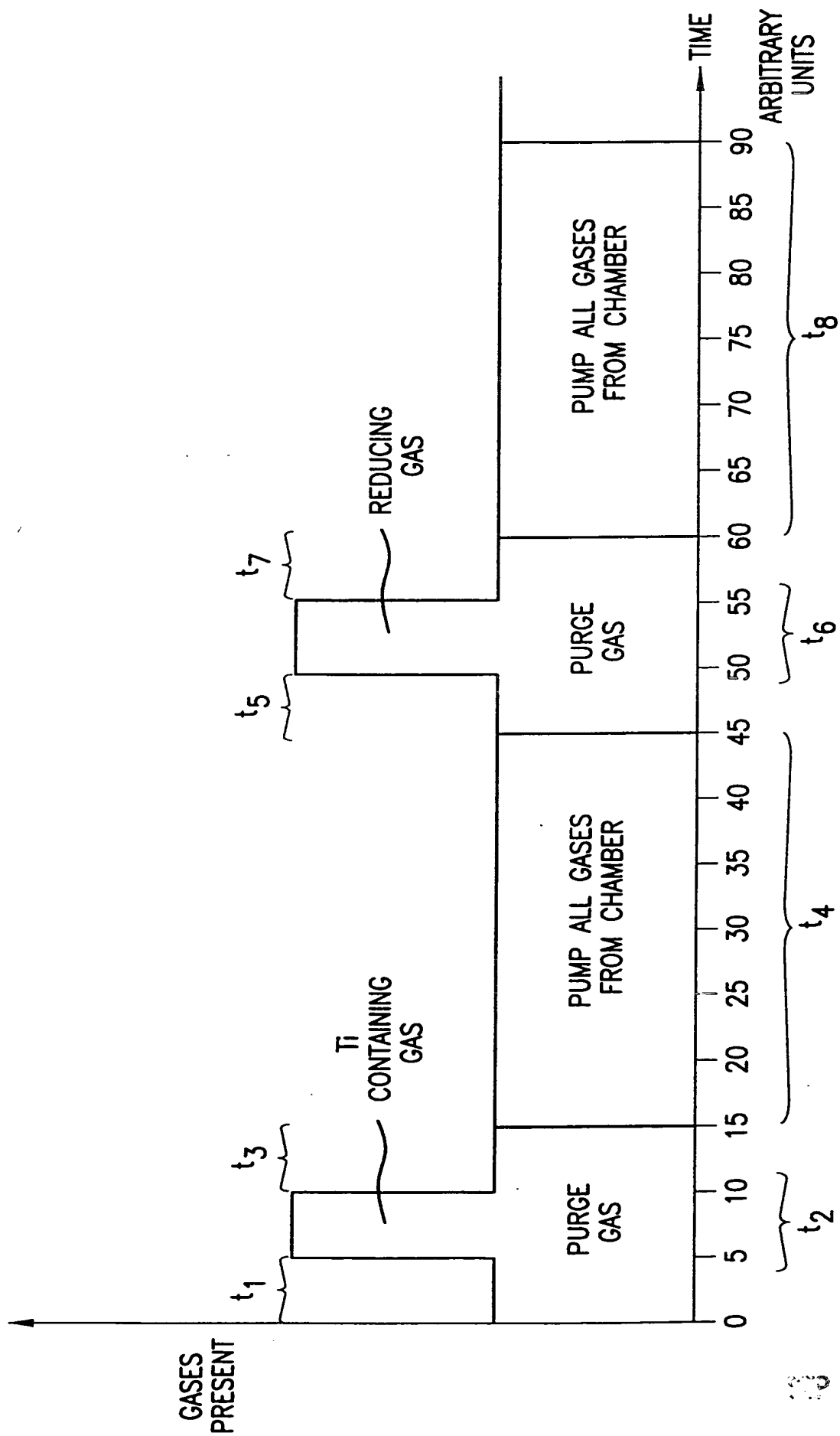
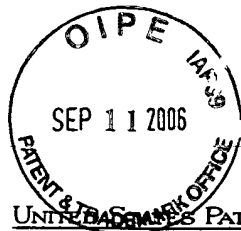


FIG. 9





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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/885,609	06/20/2001	Alfred W. Mak	5351/AMI-00-12	5337

32588 7590 03/14/2003

APPLIED MATERIALS, INC.  
2881 SCOTT BLVD. M/S 2061  
SANTA CLARA, CA 95050

EXAMINER

BERRY, RENEE R

ART UNIT PAPER NUMBER

2818

DATE MAILED: 03/14/2003

OC 6-14-03

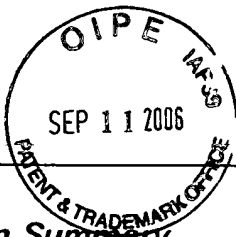
+3 9-14-03

Please find below and/or attached an Office communication concerning this application or proceeding.

203 MAR 21 PM 1:00

COMPUTER ENTER  
MAR 31 2003

SEP 13 2006



# Office Action Summary

Application No.  
09/885,609

Applicant(s)  
Mak et al.

Examiner  
Renee Berry

Art Unit  
2818



-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_\_.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-54 is/are pending in the application.
- 4a) Of the above, claim(s) 20-54 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-19 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claims \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some\* c) ☐ None of:

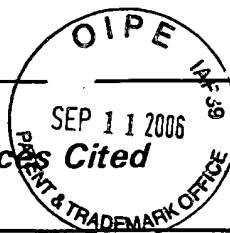
- ☐ Certified copies of the priority documents have been received.
- ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
- ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\*See the attached detailed Office action for a list of the certified copies not received.

- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). \_\_\_\_\_ 6) ☐ Other:



# Notice of References Cited

Application/Control No.  
09/885,609

Applicant(s)/Patent Under Reexam  
Mak et al.

Examiner  
Renee Berry

Art Unit  
2818

Page 1 of 1

## U.S. PATENT DOCUMENTS

	Document Number Country Code-Number-Kind Code	Date MM-YYYY <sup>1</sup>	Name	Classification <sup>2</sup>	
A	5,393,565	6/1993	Suzuki et al.	427	255.2
B	5,942,799	11/1997	Danek et al.	257	751
C	6,495,449	5/2000	Nguyen	438	627
D					
E					
F					
G					
H					
I					
J					
K					
L					
M					

## FOREIGN PATENT DOCUMENTS

	Document Number Country Code-Number-Kind Code	Date MM-YYYY <sup>1</sup>	Country	Name	Classification <sup>2</sup>	
N						
O						
P						
Q						
R						
S						
T						

## NON-PATENT DOCUMENTS

	Include, as applicable: Author, Title, Date, Publisher, Edition or Volume, Pertinent Pages
U	
V	
W	
X	

\* A copy of this reference is not being furnished with this Office action. See MPEP § 707.05(a).

<sup>1</sup> Dates in MM-YYYY format are publication dates.

<sup>2</sup> Classifications may be U.S. or foreign.



UNITED STATES PATENT AND TRADEMARK OFFICE



8(F)  
8(PB)

11.2

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## NOTICE OF ALLOWANCE AND FEE(S) DUE

COPY

32588 7590 08/02/2004

APPLIED MATERIALS, INC.  
2881 SCOTT BLVD. M/S 2061  
SANTA CLARA, CA 95050

COMPUTER ENTERED  
AUG 17 2004

REC'D AUG 19 2004

EXAMINER

BERRY, RENEE R

ART UNIT

PAPER NUMBER

2818

DATE MAILED: 08/02/2004

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/885,609	06/20/2001	Alfred W. Mak	5351/AMI-00-12	5337

TITLE OF INVENTION: SYSTEM AND METHOD TO FORM A COMPOSITE FILM STACK UTILIZING SEQUENTIAL DEPOSITION TECHNIQUES

APPLN. TYPE	SMALL ENTITY	ISSUE FEE	PUBLICATION FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	NO	\$1330	\$300	\$1630	11/02/2004

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. **PROSECUTION ON THE MERITS IS CLOSED.** THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHT. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THE STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE REFLECTS A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE APPLIED IN THIS APPLICATION. THE PTOL-85B (OR AN EQUIVALENT) MUST BE RETURNED WITHIN THIS PERIOD EVEN IF NO FEE IS DUE OR THE APPLICATION WILL BE REGARDED AS ABANDONED.

### HOW TO REPLY TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

If the SMALL ENTITY is shown as YES, verify your current SMALL ENTITY status:

A. If the status is the same, pay the TOTAL FEE(S) DUE shown above.

B. If the status above is to be removed, check box 5b on Part B - Fee(s) Transmittal and pay the PUBLICATION FEE (if required) and twice the amount of the ISSUE FEE shown above, or

If the SMALL ENTITY is shown as NO:

A. Pay TOTAL FEE(S) DUE shown above, or

B. If applicant claimed SMALL ENTITY status before, or is now claiming SMALL ENTITY status, check box 5a on Part B - Fee Transmittal and pay the PUBLICATION FEE (if required) and 1 the ISSUE FEE shown above.

II. PART B - FEE(S) TRANSMITTAL should be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). Even if the fee(s) have already been paid, Part B - Fee(s) Transmittal should be completed and returned. If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

**IMPORTANT REMINDER:** Utility patents issued on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is the patentee's responsibility to ensure timely payment of maintenance fees when due.

1 3 2006





# Notice of Allowability

Application No.

09/885,609

Examiner

Renee R Berry

Applicant(s)

MAK ET AL.

Art Unit

2818

## -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to 2/26/04.
2. ☒ The allowed claim(s) is/are 1-19 and 26-35.
3. ☒ The drawings filed on 20 June 2001 are accepted by the Examiner.
4. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☐ All b) ☐ Some\* c) ☐ None of the:
    1. ☐ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
  - \* Certified copies not received: \_\_\_\_\_.
5. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
  - (a) ☐ The translation of the foreign language provisional application has been received.
6. ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**


7. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
8. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.
  - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached
    - 1) ☐ hereto or 2) ☐ to Paper No. \_\_\_\_\_.
  - (b) ☐ including changes required by the proposed drawing correction filed \_\_\_\_\_, which has been approved by the Examiner.
  - (c) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No. \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the margin according to 37 CFR 1.121(d).

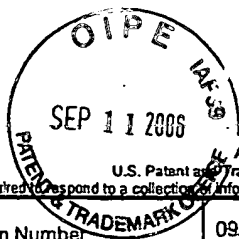
9. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

### Attachment(s)

- |  |   |
|--|---|
| 1 <input type="checkbox"/> Notice of References Cited (PTO-892)  | 5 <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)          |
| 2 <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                              | 6 <input type="checkbox"/> Interview Summary (PTO-413), Paper No. _____             |
| 3 <input checked="" type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08), Paper No. _____ | 7 <input type="checkbox"/> Examiner's Amendment/Comment                             |
| 4 <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit of Biological Material           | 8 <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance |
|  | 9 <input type="checkbox"/> Other  |

  
David Nelms  
Supervisory Patent Examiner  
Technology Center 2800

Please type a plus sign (+) inside this box →



PTO/SB/08a (CS-03)

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Substitute for form 1449A/PTO

## INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Use as many sheets as necessary)

Sheet 1

of 2

Application Number	09/885,609
Filing Date	June 20, 2001
First Named Inventor	Alfred W. Mak et al.
Group Art Unit	2818
Examiner Name	Berry, Renee R.
Attorney Docket Number	AMAT/5351/CPI/LB/PJS
Submission Date	February 26, 2004

### U.S. PATENT DOCUMENTS

Examiner Initials*	Cite No. <sup>1</sup>	Document Number	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear
		Number-Kind Code <sup>2</sup> (if known)			
<i>RAA</i>	A1	US-5,804,488	09-08-1998	Shih et al.	
<i>WJS</i>	A2	US-6,218,298 B1	04-17-2001	Hoinkis	
<i>WJS</i>	A3	US-6,335,280 B1	01-01-2002	Van der Jeugd	
<i>WJS</i>	A4	US-6,551,929 B1	04-22-2003	Kori et al.	
<i>WJS</i>	A5	US-6,599,572 B2	07-29-2003	Saanila et al.	
<i>WJS</i>	A6	US-6,607,976 B2	08-19-2003	Chen et al.	
<i>WJS</i>	A7	US-6,632,279 B1	10-14-2003	Ritala et al.	
<i>WJS</i>	A8	US-6,686,271 B2	02-03-2004	Raaijmakers et al.	
<i>WJS</i>	A9	US-2002/0086111 A1	07-04-2002	Byun et al.	
<i>WJS</i>	A10	US-2002/0121241 A1	09-05-2002	Nguyen et al.	
<i>WJS</i>	A11	US-2002/0121342 A1	09-05-2002	Nguyen et al.	
<i>WJS</i>	A12	US-2003/0013300 A1	01-16-2003	Byun	
<i>WJS</i>	A13	US-2003/0054631 A1	03-20-2003	Raaijmakers et al.	
<i>WJS</i>	A14	US-2003/0089308 A1	05-15-2003	Raaijmakers	
<i>WJS</i>	A15	US-2003/0101927 A1	06-05-2003	Raaijmakers	
<i>WJS</i>	A16	US-2003/0104126 A1	06-05-2003	Fang et al.	
<i>WJS</i>	A17	US-2003/0129826 A1	07-10-2003	Werkhoven et al.	
<i>WJS</i>	A18	US-2003/0134508 A1	07-17-2003	Raaijmakers et al.	

### FOREIGN PATENT DOCUMENTS

Examiner Initials*	Cite No. <sup>1</sup>	Foreign Patent Document	Publication Date MM-DD-YYYY	Name of Patentee or Applicant of Cited Document	Pages, Columns, Lines, Where Relevant Passages or Relevant Figures Appear	T <sup>6</sup>
		Number-Kind Code <sup>2</sup> (if known)				
<i>WJS</i>	B1	WO 02/01628 A2	01-03-2002	Byun et al.		
<i>WJS</i>	B2	WO 02/45871 A1	06-13-2002	Chiang et al.		
	B3					
	B4					

Examiner *WJS*

Date Considered 7-10-04

EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant. \* Applicant's unique citation designation number (optional). \* See Kinds Codes of USPTO Patent Documents at [www.uspto.gov](http://www.uspto.gov) or MPEP 901.04. \* Enter Office that issued the document, by the two-letter code (WIPO Standard ST.3). \* For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. \* Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. \* Applicant is to place a check mark here if English language Translation is attached.

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 2 hours to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450. If you need assistance in completing the form, call 1-800-PTO-9199 (1-800-786-9199) and select option 2.

**PATENT**  
Atty. Dkt. APPM/5351/CPI/LB/PJS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:  
Mak, et al.

Serial No.: 09/885,609

Confirmation No.: 5337

Filed: June 20, 2001

**For: System and Method to Form a Composite Film Stack Utilizing Sequential Deposition Techniques**

Group Art Unit: 2812

Examiner: R. Berry

Assistant Commissioner for Patents  
Washington, D.C. 20231


Dear Sir:

COPY

**CERTIFICATE OF MAILING**  
**37 CFR 1.8**

I hereby certify that this correspondence is being deposited on May 2, 2000 with the United States Postal Service as First Class Mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231.

5/2/02  
Date

D.C. 20231.  
  
 Signature

## SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

The Applicants, and the Attorney who signs below on the basis of the information supplied by the inventor and the information in his file, submit herewith patents, publications, or other information of which they are aware, which may be material to the examination of this application and in respect of which there may be a duty to disclose in accordance with 37 CFR § 1.56.

While the information submitted in this Supplemental Information Disclosure Statement may be material pursuant to 37 CFR § 1.56, it is not intended to constitute an admission that any patent, publication, or other information referred to therein is prior art for this invention unless specifically designated as such.

In accordance with 37 CFR § 1.97, this Supplemental Information Disclosure Statement is not to be construed as a representation that a search has been made or that no other possibly material information as defined under 37 CFR § 1.56(a) exists.

The patents and/or publications submitted herewith are set forth on the attached Form PTO-1449.

'SEP 13 2006

If the sum of \$180.00 is due under 37 CFR § 1.17(p) pursuant to § 1.97, the Commissioner is hereby authorized to charge this fee, and any other fee necessary to make this submission timely, to the Deposit Account No. 20-0782/APPM/5351/BTP.

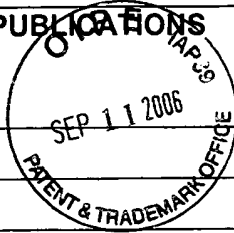
Respectfully submitted,



---

Keith M. Tackett  
Registration No. 32,008  
MOSER, PATTERSON & SHERIDAN, L.L.P.  
3040 Post Oak Blvd., Suite 1500  
Houston, TX 77056  
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Facsimile: (713) 623-4846  
Attorney for Applicant(s)

U.S. Department of Commerce, Patent and Trademark Office (PTO Form 1449 modified)		Docket No. APPM/5351	Serial No. 09/885,609
<b>SUPPLEMENTAL LIST OF PATENTS AND PUBLICATIONS CITED BY APPLICANT</b>		Applicant Mak, et al.	Confirmation No.: 5337
(Use several sheets if necessary)		Filing Date June 20, 2001	Group 2812
Examiner Berry			



**U.S. Patent Documents**

*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate
	A1	4,813,846	03/21/89	Helms	414	744.1	04/29/87
	A2	4,917,556	04/17/90	Stark et al.	414	217	05/26/89
	A3	4,951,601	08/28/90	Maydan, et al.	118	719	06/23/89
	A4	5,000,113	03/19/91	Wang et al.	118	723	12/19/86
	A5	5,028,565	07/02/1991	Chang, et al.	437	192	08/25/1989
	A6	5,173,474	12/22/1992	Connell, et al.	505	1	03/11/1991
	A7	5,186,718	02/16/93	Tepman et al.	29	25.01	04/15/91
	A8	5,205,077	04/27/93	Wittstock	51	165 R	08/28/91
	A9	5,234,561	08/10/93	Randhawa et al.	204	192.38	08/25/88
	A10	5,259,881	11/09/93	Edwards, et al.	118	719	05/17/91
	A11	5,286,296	02/15/94	Sato et al.	118	719	01/09/92
	A12	5,580,380	12/03/1996	Liu, et al.	117	86	01/30/1995
	A13	5,609,689	03/11/97	Kato et al.	118	719	06/03/96
	A14	5,667,592	09/16/97	Boitnott et al.	118	719	04/16/96
	A15	5,674,786	10/07/97	Turner et al.	437	225	06/05/95
	A16	5,695,564	12/09/97	Imahashi	118	719	08/03/95
	A17	5,730,801	03/24/98	Tepman et al.	118	719	08/23/94
	A18	5,788,447	08/04/98	Yonemitsu et al.	414	217	08/05/96
	A19	5,788,799	08/04/98	Steger, et al.	156	345	06/11/96
	A20	5,801,634	09/01/98	Young et al.	340	635	09/08/97
	A21	5,856,219	01/05/99	Naito et al.	438	241	08/18/97
	A22	5,866,213	02/02/99	Foster et al.	427	573	07/19/97
	A23	5,866,795	02/02/99	Wang et al.	73	1.36	03/17/97
	A24	5,882,165	03/16/99	Maydan et al.	414	217	09/10/97
	A25	5,882,413	03/16/99	Beaulieu et al.	118	719	07/11/97
	A26	5,928,389	07/27/99	Jevtic	29	25.01	10/21/96

Examiner

Date Considered

\*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with your communication to applicant.

SEP 13 2006

U.S. Department of Commerce, Patent and Trademark Office					Docket No.		Serial No.	
(PTO Form 1449 modified)					APPM/5351		09/885,609	
SUPPLEMENTAL LIST OF PATENTS AND PUBLICATIONS CITED BY APPLICANT					Applicant		Confirmation No.:	
					Mak, et al.		5337	
(Use several sheets if necessary)					Filing Date		Group	
Examiner Berry					June 20, 2001		2812	
U.S. Patent Documents								
*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate	
	A27	6,051,286	04/18/00	Zhao et al.	427	576	08/22/97	
	A28	6,062,798	05/16/00	Muka	414	416	06/13/96	
	A29	6,071,808	06/06/00	Merchant et al.	438	633	06/23/99	
	A30	6,084,302	07/04/00	Sandhu	257	751	12/26/95	
	A31	6,086,677	07/11/00	Umotoy et al.	118	715	06/16/98	
	A32	6,110,556	08/29/00	Bang, et al.	428	64.1	10/17/97	
	A33	6,117,244	09/12/00	Bang, et al.	118	715	03/24/98	
	A34	6,140,237	10/31/00	Chan et al.	438	687	04/19/99	
	A35	6,140,238	10/31/00	Kitch	438	687	04/21/99	
	A36	6,143,659	11/07/00	Leem	438	688	08/27/98	
	A37	6,144,060	11/07/00	Park et al.	257	310	07/31/98	
	A38	6,158,446	12/12/00	Mohindra et al.	134	25.4	09/04/98	
	A39	6,206,967	03/27/01	Mak, et al.	118	666	06/14/00	
	A40	6,271,148	08/07/01	Kao et al.	438	727	10/13/99	
	A41	2001/0041250	11/15/01	Werkhoven et al.	428	212	03/06/01	
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(Use several sheets if necessary)					Filing Date		Group	
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Examiner Berry		June 20, 2001	2812

**Foreign Patent Documents**

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Examiner					Date Considered			
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U.S. Department of Commerce, Patent and Trademark Office					Docket No.		Serial No.	
(PTO Form 1449 modified)					APPM/5351		09/885,609	
SUPPLEMENTAL LIST OF PATENTS AND PUBLICATIONS CITED BY APPLICANT					Applicant Mak, et al.		Confirmation No.: 5337	
(Use several sheets if necessary)					Filing Date		Group	
Examiner     Berry					June 20, 2001		2812	
<b>Foreign Patent Documents</b>								
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	B156	00/11721	03/02/2000	WO	H01L	29/43	<input type="checkbox"/>	<input type="checkbox"/>
	B157	90/02216	03/08/1990	WO	C23C	14/34	<input type="checkbox"/>	<input type="checkbox"/>
	B158	98/06889	02/19/1998	WO	D06F		<input type="checkbox"/>	<input type="checkbox"/>
Examiner					Date Considered			
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		Mak, et al.	5337
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Examiner Berry		June 20, 2001	2812
<b>OTHER ART</b>			
*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.	
	C1	Ohba, et al., "Thermal Decomposition of Methylhydrazine and Deposition Properties of CVD TiN Thin Films", Conference Proceedings, Advanced Metallization for ULSI Applications in 1993 (1994), pp. 143-149	
	C2	Scheper, et al., "Low-temperature deposition of titanium nitride films from dialkylhydrazine-based precursors", Materials Science in Semiconductor Processing 2 (1999), pp. 149-157	
	C3	Suzuki, et al., "A 0.2- $\mu$ m contact filing by 450°C-hydrazine-reduced TiN film with low resistivity", IEDM 92-979, pp. 11.8.1 – 11.8.3	
	C4	Suzuki, et al., "LPCVD-TiN Using Hydrazine and TiCl <sub>4</sub> ", VMIC Conference (June 8-9, 1993), pp. 418-423	
	C5	IBM Tech. Disc. Bull. "Knowledge-Based Dynamic Scheduler in Distributed Computer Control, (June 1990), pp. 80-84	
	C6	IBM Tech. Disc. Bull. "Multiprocessor and Multitasking Architecture for Tool Control of the Advanced via Inspection Tools" (May 1992), pp. 190-191	
	C7	McGeachin, S., "Synthesis and properties of some $\beta$ -diketimines derived from acetylacetone, and their metal complexes", Canadian J. of Chemistry, Vol. 46 (1968), pp.1903-1912	
	C8	Solanki, et al., "Atomic Layer deposition of Copper Seed Layers", Electrochemical and Solid State Letters, 3(10) (2000), pp. 479-480	
	C9	NERAC.COM Retro Search: Atomic Layer Deposition of Copper, dated October 11, 2001	
	C10	NERAC.COM Retro Search: Atomic Layer Deposition / Epitaxy Aluminum Oxide Plasma, dated October 2, 2001	
	C11	NERAC Search abstract of "Atomic Layer deposition of Ta and Ti for Interconnect Diffusion Barriers", by Rossnagel, et al., J. Vac. Sci. & Tech., 18(4) (July 2000)	
	C12	Abstracts of articles re atomic layer deposition	
	C13	Abstracts of search results re atomic layer deposition, search dated January 24, 2002	
	C14	Abstracts of articles re atomic layer deposition and atomic layer nucleation	
	C15	Abstracts of articles re atomic layer deposition and semiconductors and copper	
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*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.	
	C16	Abstracts of articles – atomic layer deposition	
	C17	NERAC Search – Atomic Layer Deposition, search dated October 16, 2001	
	C18	Bader, et al., "Integrated Processing Equipment", Solid State Technology, Cowan Pub., Vol. 33, No. 5 (May 1, 1990), pp. 149-154	
	C19	Choi, et al., "The effect of annealing on resistivity of low pressure chemical vapor deposited titanium diboride", J. Appl. Phys. 69(11) (June 1, 1991), pp. 7853-7861	
	C20	Choi, et al., "Stability of TiB <sub>2</sub> as a Diffusion Barrier on Silicon", J. Electrochem. Soc. 138(10) (October 1991), pp. 3062-3067	
	C21	"Cluster Tools for Fabrication of Advanced devices" Jap. J. of Applied Physics, Extended Abstracts, 22 <sup>nd</sup> Conference Solid State Devices and Materials (1990), pp. 849 – 852 XP000178141	
	C22	"Applications of Integrated processing", Solid State Technology, US, Cowan Pub., Vol 37, No. 12 (December 1, 1994), pp. 45-47	
	C23	Kitigawa, et al., "Hydrogen-mediated low temperature epitaxy of Si in plasma-enhanced chemical vapor deposition", Applied Surface Science (2000), pp. 30-34	
	C24	Lee, et al., "Pulsed nucleation for ultra-high aspect ratio tungsten plugfill", Novellus Systems, Inc. (2001), pp. 1-2 (COPY NOT AVAILABLE TO APPLICANT AT THIS TIME)	
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SEP 13 2001

DOCKET No.: APP 15351  
SERIAL No.: 091995-609  
FILED: 20 JUL 2001  
APPLICANT: Applied Materials  
INVENTOR: Mat, et al.

The Patent & Trademark Office acknowledges and has stamped hereon the date of receipt of the items checked below which were mailed 2 May 2002

- ☐ AFFIDAVIT  
☐ AMENDMENT  
☐ APPLICATION PAPERS - OATH/DECLARATION  
☐ TOTAL CLS. IND. CLS. FEE \$  
☐ SHEET(S) OF DRAWING(S) FORMAL/INFORMAL  
☐ ASSIGNMENT-RECORDAL FEE \$  
☐ BRIEF  
☐ APPEAL NOTICE  
☐ DECLARATION  
☐ ISSUE FEE - BASE/BALANCE  
☐ LETTER - CHARGE DEPOSIT ACCOUNT  
☐ LETTER  
☐ TRADEMARK/SERVICE MARK APPLICATION  
☐ PETITION  
☐ PRELIMINARY AMENDMENT  
☒ INFORMATION DISCLOSURE STATEMENT (Supp)  
☐ REQUEST FOR EXTENSION OF TIME  
☐ RESPONSE TO  
☐ SPECIMENS  
☐ SMALL ENTITY  
☐ CHECK #  
☐ CHECK #  
☒ Cited Art. 1449, postcards

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SEP 13 2006

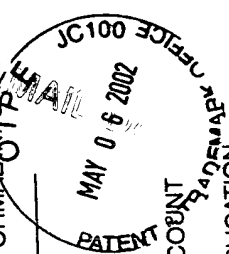
DOCKET No.: APP 15351  
SERIAL No.: 091995-609  
FILED: 20 JUL 2001  
APPLICANT: Applied Materials  
INVENTOR: Mat, et al.

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APPLICANT: Applied Materials  
INVENTOR: Mat, et al.

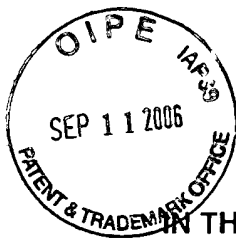
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PATENT  
Atty. Dkt. AMAT/5351/CP/B/PJS

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:  
Mak, et al.

Serial No.: 09/885,609

Confirmation No.: 5337

Filed: June 20, 2001

For: System and Method to  
Form a Composite Film  
Stack Utilizing Sequential  
Deposition Techniques

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Group Art Unit: 2812

Examiner: Unknown

Assistant Commissioner for Patents  
Washington, D.C. 20231

Dear Sir:

CERTIFICATE OF MAILING 37 CFR 1.8	
I hereby certify that this correspondence is being deposited on <u>3/29</u> , 2002 with the United States Postal Service as First Class Mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231.	
<u>3/29/02</u> Date	<u>[Signature]</u> Signature

SUPPLEMENTAL INFORMATION DISCLOSURE STATEMENT

The Applicants, and the Attorney who signs below on the basis of the information supplied by the inventor and the information in his file, submit herewith patents, publications, or other information of which they are aware, which may be material to the examination of this application and in respect of which there may be a duty to disclose in accordance with 37 CFR § 1.56.

While the information submitted in this Supplemental Information Disclosure Statement may be material pursuant to 37 CFR § 1.56, it is not intended to constitute an admission that any patent, publication, or other information referred to therein is prior art for this invention unless specifically designated as such.

In accordance with 37 CFR § 1.97, this Supplemental Information Disclosure Statement is not to be construed as a representation that a search has been made or that no other possibly material information as defined under 37 CFR § 1.56(a) exists.

The patents and/or publications submitted herewith are set forth on the attached Form PTO-1449.

If the sum of \$180.00 is due under 37 CFR § 1.17(p) pursuant to § 1.97, the Commissioner is hereby authorized to charge this fee, and any other fee necessary to make this submission timely, to the Deposit Account No. 20-0782/AMAT/5351/CPI/B/PJS/KMT.


Respectfully submitted,



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Attorney for Applicants

U.S. Department of Commerce, Patent and Trademark Office (PTO Form 1449 modified)					Docket No. AMAT/5351		Serial No. 09/885,609	
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Examiner Unknown								



U.S. Patent Documents							
*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate
	A1	4,486,487	12/04/84	Skarp	428	216	04/25/1983
	A2	4,829,022	05/09/89	Kobayashi et al.	437	107	12/09/1986
	A3	4,834,831	05/30/89	Nishizawa et al.	156	611	09/04/1987
	A4	4,838,983	06/13/89	Schumaker et al.	156	613	03/18/1988
	A5	4,838,993	06/13/89	Aoki et al.	156	643	12/03/1987
	A6	4,859,625	08/22/89	Nishizawa et al.	437	81	11/20/1987
	A7	4,927,670	05/22/1990	Erbil	427	255.3	06/22/1988
	A8	4,931,132	06/05/90	Aspnes et al.	156	601	10/07/1988
	A9	4,960,720	10/02/90	Shimbo	437	105	08/24/1987
	A10	4,975,252	12/04/90	Nishizawa et al.	422	245	05/26/1989
	A11	5,013,683	05/07/91	Petroff et al.	437	110	01/23/1989
	A12	5,085,885	02/04/92	Foley et al.	477	38	09/10/1990
	A13	5,091,320	02/25/92	Aspnes et al.	437	8	06/15/1990

Foreign Patent Documents								
*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B1	01/66832 A2	09/13/2001	WO	C30B	16/44		X
	B2	01/40541 A1	06/07/2001	WO	C23C	16/40		X
	B3	01/36702 A1	05/25/2001	WO	C23C	16/00		X
	B4	01/29893 A1	04/26/2001	WO	H01L	21/768		X
	B5	01/29891 A1	04/26/2001	WO	H01L	21/768		X

OTHER ART	
*Examiner Initial	Including Author, Title, Date, Pertinent Pages, Etc.
C1	Hultman, et al., "Review of the thermal and mechanical stability of TiN-based thin films", <i>Zeitschrift Fur Metallkunde</i> , 90(10) (Oct. 1999), pp. 803-813.
C2	Klaus, et al., "Atomic Layer Deposition of SiO <sub>2</sub> Using Catalyzed and Uncatalyzed Self-Limiting Surface Reactions", <i>Surface Review &amp; Letters</i> , 6(3&4) (1999), pp. 435-448.

Examiner	Date Considered
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	A14	5,246,536	09/21/93	Nishizawa et al.	156	610	03/10/1989	
	A15	5,254,207	10/19/93	Nishizawa et al.	156	601	11/30/1992	
	A16	5,296,403	03/22/94	Nishizawa et al.	437	133	10/23/1992	
	A17	5,311,055	05/10/94	Goodman et al.	257	593	11/22/1991	
	A18	5,316,615	05/31/94	Copel	117	95	03/09/1993	
	A19	5,348,911	09/20/94	Jurgensen et al.	117	91	04/26/1993	
	A20	5,438,952	08/08/1995	Otsuka	117	84	01/31/1994	
	A21	5,439,876	08/08/95	Graf et al.	505	447	08/16/1993	
	A22	5,441,703	08/15/95	Jurgensen	422	129	03/29/1994	
	A23	5,455,072	10/03/95	Bension et al.	427	255.7	11/18/1992	
	A24	5,469,806	11/28/95	Mochizuki et al.	117	97	08/20/1993	
	A25	5,503,875	04/02/96	Imai et al.	427	255.3	03/17/1994	
	A26	5,521,126	05/28/96	Okamura et al.	437	235	06/22/1994	
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<b>Foreign Patent Documents</b>								
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	B6	01/29280 A1	04/26/2001	WO	C23C	16/32		X
	B7	01/27347 A1	04/19/2001	WO	C23C	16/44		X
	B8	01/27346 A1	04/19/2001	WO	C23C	16/44		X
	B9	01/15220 A1	03/01/2001	WO	H01L	21/768		X
<b>OTHER ART</b>								
*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.						
	C3	Yamaguchi, et al., "Atomic-layer chemical-vapor-deposition of silicon dioxide films with extremely low hydrogen content", <i>Appl. Surf. Sci.</i> , Vol. 130-132 (1998), pp. 202-207.						
	C4	George, et al., "Surface Chemistry for Atomic Layer Growth", <i>J. Phys. Chem.</i> , Vol. 100 (1996), pp. 13121-131.						
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	A28	5,540,783	07/30/96	Eres et al.	118	725	05/26/1994	
	A29	5,601,651	02/11/97	Watabe	118	715	12/14/1994	
	A30	5,616,181	04/01/97	Yamamoto et al.	118	723 ER	11/21/1995	
	A31	5,641,984	06/24/97	Aftergut et al.	257	433	08/19/1994	
	A32	5,644,128	07/01/97	Wollnik et al.	250	251	08/25/1994	
	A33	5,707,880	01/13/98	Aftergut et al.	437	3	01/17/1997	
	A34	5,747,113	05/05/98	Tsai	427	255.5	07/29/1996	
	A35	5,749,974	05/12/98	Habuka et al.	118	725	07/13/1995	
	A36	5,796,116	08/18/98	Nakata et al.	257	66	07/25/1995	
	A37	5,807,792	09/15/98	Ilg et al.	438	758	12/18/1996	
	A38	5,830,270	11/03/98	McKee et al.	117	106	08/05/1996	
	A39	5,835,677	11/10/98	Li et al.	392	401	10/03/1996	
	A40	5,855,675	01/05/99	Doering et al.	118	719	03/03/1997	
<b>Foreign Patent Documents</b>								
*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B10	00/79576 A1	12/28/2000	WO	H01L	21/205		X
	B11	00/79019 A1	12/28/2000	WO	C23C	16/00		X
	B12	00/63957 A1	10/26/2000	WO	H01L	21/205		X
<b>OTHER ART</b>								
*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.						
	C5	George, et al., "Atomic layer controlled deposition of SiO <sub>2</sub> and Al <sub>2</sub> O <sub>3</sub> using ABAB...binary reaction sequence chemistry", <i>Appl. Surf. Sci.</i> , Vol. 82/83 (1994), pp. 460-467.						
	C6	Wise, et al., "Diethyldiethoxysilane as a new precursor for SiO <sub>2</sub> growth on silicon", <i>Mat. Res. Soc. Symp. Proc.</i> , Vol. 334 (1994), pp. 37-43.						
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	A41	5,858,102	01/12/99	Tsai	118	719	02/14/1998	
	A42	5,904,565	05/18/1999	Nguyen, et al.	438	687	07/17/1997	
	A43	5,923,056	07/13/99	Lee et al.	257	192	03/12/1998	
	A44	5,923,985	07/13/99	Aoki et al.	438	301	01/14/1997	
	A45	5,925,574	07/20/99	Aoki et al.	437	31	04/10/1992	
	A46	5,942,040	08/24/99	Kim et al.	118	726	08/27/1997	
	A47	5,947,710	09/07/1999	Cooper, et al.	418	63	06/16/1997	
	A48	5,972,430	10/26/99	DiMeo, Jr. et al.	427	255.32	11/26/1997	
	A49	6,001,669	12/14/99	Gaines et al.	438	102	07/21/1992	
	A50	6,174,377	01/16/2001	Doering, et al.	118	729	01/04/1999	
	A51	6,174,809	01/16/2001	Kang, et al.	438	682	12/15/1998	
	A52	6,203,613	03/20/2001	Gates, et al.	117	104	10/19/1999	
	A53	6,207,302	03/27/2001	Sugiura, et al.	428	690	03/02/1998	
	A54	6,248,605	06/19/2001	Harkonen, et al.	438	29	06/02/1999	
<b>Foreign Patent Documents</b>								
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	B13	00/54320 A1	09/14/2000	WO	H01L	21/44		X
	B14	00/16377 A2	03/23/2000	WO	H01L	---		X
	B15	00/15881 A2	03/23/2000	WO	C30B	---		X
<b>OTHER ART</b>								
*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.						
	C7	Niinisto, et al., "Synthesis of oxide thin films and overlayers by atomic layer epitaxy for advanced applications", <i>Mat. Sci. &amp; Eng.</i> , Vol. B41 (1996), pp. 23-29.						
	C8	Ritala, et al., "Perfectly conformal TiN and Al <sub>2</sub> O <sub>3</sub> films deposited by atomic layer deposition", <i>Chemical Vapor Deposition</i> , Vol. 5(1) (January 1999), pp. 7-9.						
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U.S. Department of Commerce, Patent and Trademark Office (PTO Form 1449 modified)					Docket No. AMAT/5351		Serial No. 09/885,609	
<b>LIST OF PATENTS AND PUBLICATIONS CITED BY APPLICANT</b>					Applicant Mak, et al.		Confirmation No. 5337	
(Use several sheets if necessary)					Filing Date June 20, 2001		Group 2812	
Examiner Unknown								
<b>U.S. Patent Documents</b>								
*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate	
	A55	6,270,572	08/07/2001	Kim, et al.	117	93	08/09/1999	
	A56	6,287,965	09/11/2001	Kang, et al.	438	648	02/23/2000	
	A57	6,291,876	09/18/2001	Stumborg, et al.	257	632	08/20/1998	
	A58	6,305,314	10/23/2001	Sneh, et al.	118	723 R	12/17/1999	
	A59	6,306,216	10/23/2001	Kim, et al.	118	725	07/12/2000	
	A60	6,316,098	11/13/2001	Yitzchaik, et al.	428	339	03/23/1999	
	A61	2001/0000866	05/10/2001	Sneh, et al.	118	723 R	11/29/2000	
	A62	2001/0009140	07/26/2001	Bondestam, et al.	118	725	01/25/2001	
	A63	2001/0011526	08/09/2001	Doering, et al.	118	729	01/16/2001	
	A64	2001/0031562	10/18/2001	Raaijmakers, et al.	438	770	02/22/2001	
	A65	2001/0034123	10/25/2001	Jeon, et al.	438	643	04/06/2001	
	A66							
	A67							
<b>Foreign Patent Documents</b>								
*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B16	99/41423 A2	08/19/1999	WO	C23C	---		X
	B17	96/18756 A1	06/20/1996	WO	C23C	16/08		X
<b>OTHER ART</b>								
*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.						
	C9	Min, et al., "Atomic layer deposition of TiN thin films by sequential introduction of Ti precursor and NH/sub3", <i>Symp.: Advanced Interconnects and Contact Materials and Processes for Future Integrated Circuits</i> (Apr. 13-16, 1998), pp. 337-342.						
	C10	Klaus, et al., "Atomic Layer Deposition of Tungsten using Sequential Surface Chemistry with a Sacrificial Stripping Reaction," <i>Thin Solid Films</i> 360 (2000), Pages 145 – 153, (Accepted Nov. 16, 1999).						
Examiner					Date Considered			
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					Mak, et al.		No. 5337	
(Use several sheets if necessary)					Filing Date		Group	
Examiner Unknown					June 20, 2001		2812	
<b>U.S. Patent Documents</b>								
*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate	
	A68							
	A69							
	A70							
	A71							
	A72							
	A73							
	A74							
	A75							
	A76							
<b>Foreign Patent Documents</b>								
*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B18	96/17107 A1	06/06/1996	WO	C23C	16/44		X
	B19	93/02111 A1	02/04/1993	WO	C08F	4/78		X
	B20	0 442 490 A1	08/21/1991	EP	C30B	25/02		X
	B21	0 344 352 A1	12/06/1989	EP	H01L	39/24		X
<b>OTHER ART</b>								
*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.						
	C11	Min, et al., "Metal-Organic Atomic-Layer Deposition of Titanium-Silicon-Nitride Films", <i>Applied Physics Letters</i> , American Inst. Of Physics, Vol 75(11) (Sept. 13, 1999).						
	C12	Martensson, et al., "Atomic Layer Epitaxy of Copper on Tantalum", <i>Chemical Vapor Deposition</i> , 3(1) (Feb. 1, 1997), pp. 45-50.						
Examiner					Date Considered			
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(Use several sheets if necessary)					Filing Date		Group	
Examiner Unknown					June 20, 2001		2812	
<b>U.S. Patent Documents</b>								
*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate	
	A77							
	A78							
	A79							
	A80							
<b>Foreign Patent Documents</b>								
*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B22	62-091495 A	04/25/1987	JP	C30B	25/02		X
	B23	60-065712 A	04/15/1985	JP	C01B	33/113		X
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	B25	03-286531	12/17/1991	JP	H01L	21/316		X
	B26	04-031396 A	02/03/1992	JP	C30B	25/14		X
	B27	06-291048	10/18/1994	JP	H01L	21/205		X
	B28	08-264530	10/11/1996	JP	H01L	21/3205		X
	B29	11-269652	10/05/1999	JP	C23C	16/44		X
<b>OTHER ART</b>								
*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.						
	C13	Ritala, et al. "Atomic Layer Epitaxy Growth of TiN Thin Films", <i>J. Electrochem. Soc.</i> , 142(8) (Aug. 1995), pp. 2731-737.						
	C14	Elers, et al., "NbC15 as a precursor in atomic layer epitaxy", <i>Appl. Surf. Sci.</i> , Vol. 82/83 (1994), pp. 468-474.						
	C15	Lee, "The Preparation of Titanium-Based Thin Film by CVD Using Titanium Chlorides as Precursors", <i>Chemical Vapor Deposition</i> , 5(2) (Mar. 1999), pp. 69-73.						
	C16	Martensson, et al., "Atomic Layer Epitaxy of Copper, Growth & Selectivity in the Cu (II)-2,2,6,6-Tetramethyl-3, 5-Heptanedion ATE/H2 Process", <i>J. Electrochem. Soc.</i> , 145(8) (Aug. 1998), pp. 2926-2931.						
Examiner					Date Considered			
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<b>LIST OF PATENTS AND PUBLICATIONS CITED BY APPLICANT</b>					Applicant Mak, et al.		Confirmation No. 5337	
(Use several sheets if necessary)					Filing Date		Group	
Examiner Unknown					June 20, 2001		2812	
<b>U.S. Patent Documents</b>								
*Examiner Initial		Document Number	Issue Date	Applicant(s) Name	Class	Subclass	Filing Date If Appropriate	
	A81							
	A82							
	A83							
	A84							
	A85							
	A86							
	A87							
	A88							
<b>Foreign Patent Documents</b>								
*Examiner Initial		Document Number	Date	Country	Class	Subclass	Translation	
							YES	NO
	B30	2001-62244	03/13/2001	JP	B01D	53/34		X
	B31	198 20 147	07/01/1999	DE	H01L	21/3205		X
	B32	196 27 017	01/09/1997	DE	H01L	21/283		X
	B33	2 626 110	07/21/1989	FR	H01L	39/24		X
	B34	2 692 597	12/24/1993	FR	C23C	16/00		X
	B35	2 355 727	05/02/2001	GB	C23C	16/44		X
<b>OTHER ART</b>								
*Examiner Initial		Including Author, Title, Date, Pertinent Pages, Etc.						
	C17	Min, et al., "Chemical Vapor Deposition of Ti-Si-N Films with Alternating Source Supply", <i>Mat., Res. Soc. Symp. Proc.</i> , Vol. 564 (Apr. 5, 1999), pp. 207-210						
	C18	Bedair, "Atomic layer epitaxy deposition processes", <i>J. Vac. Sci. Technol.</i> 12(1) (Jan/Feb 1994)						
	C19	Yamaga, et al., "Atomic layer epitaxy of ZnS by a new gas supplying system in a low-pressure metalorganic vapor phase epitaxy", <i>J. of Crystal Growth</i> 117 (1992), pp. 152-155						
	C20	Elam, et al., "Nucleation and growth during tungsten atomic layer deposition on SiO <sub>2</sub> surfaces," <i>Thin Solid Films</i> 386 (2001) Pages 41 – 52, (Accepted Dec. 14, 2000).						
Examiner					Date Considered			
*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with your communication to applicant.								



SEP 13 2006

DOCKET No.: AMAT/5351  
SERIAL No.: 091885 609  
FILED: 20 June 2007  
APPLICANT: Applied Materials, Inc.  
INVENTOR: MAI, et al.

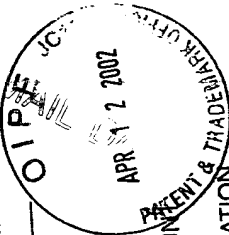
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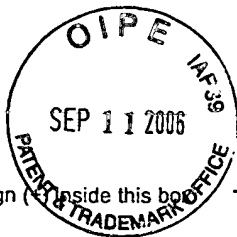
- ☐ AFFIDAVIT  
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☐ APPLICATION PAPERS - OATH/DECLARATION  
☐ TOTAL CLS. IND. CLS. FEE \$  
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☐ DECLARATION  
☐ ISSUE FEE - BASE/BALANCE  
☐ LETTER - CHARGE DEPOSIT ACCOUNT  
☐ LETTER  
☐ TRADEMARK/SERVICEMARK APPLICATION  
☐ PETITION  
☐ PRELIMINARY AMENDMENT  
☒ INFORMATION DISCLOSURE STATEMENT  
☐ REQUEST FOR EXTENSION OF TIME  
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☐ SPECIMENS  
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DOCKET No.: AMAT/5351  
SERIAL No.: 091885 609  
FILED: 20 June 2007  
APPLICANT: Applied Materials, Inc.  
INVENTOR: MAI, et al.

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☐ SHEET(S) OF DRAWING(S) FORMAL/INFORMAL  
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☐ SMALL ENTITY  
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PTO/SB/21 (08-00)

Approved for use through 10/31/2002. OMB 0651-0031

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<b>TRANSMITTAL FORM</b> (to be used for all correspondence after initial filing)	Application Number	09/885,609	
	Filing Date	Jun 20, 2001	
	First Named Inventor	Mak, Alfred W.	
	Group Art Unit	2812	
	Examiner Name	Unknown	
Total Number of Pages in This Submission	8	Attorney Docket Number	5351/AMI-00-12

ENCLOSURES (check all that apply)		
<input type="checkbox"/> Fee Transmittal Form	<input type="checkbox"/> Assignment Papers (for an Application)	<input type="checkbox"/> After Allowance Communication to Group
<input type="checkbox"/> Fee Attached	<input checked="" type="checkbox"/> Drawings (six sheets formal)	<input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences
<input type="checkbox"/> Amendment / Reply	<input type="checkbox"/> Licensing-related Papers	<input type="checkbox"/> Appeal Communication to Group (Appeal Notice, Brief, Reply Brief)
<input type="checkbox"/> After Final	<input type="checkbox"/> Petition	<input type="checkbox"/> Proprietary Information
<input type="checkbox"/> Affidavits/declaration(s)	<input type="checkbox"/> Petition to Convert to a Provisional Application	<input type="checkbox"/> Status Letter
<input type="checkbox"/> Extension of Time Request	<input type="checkbox"/> Power of Attorney, Revocation Change of Correspondence Address	<input checked="" type="checkbox"/> Other Enclosure(s) (please identify below):
<input type="checkbox"/> Express Abandonment Request	<input type="checkbox"/> Terminal Disclaimer	1. Return Receipt Postcard to Kenneth C. Brooks
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<input type="checkbox"/> Certified Copy of Priority Document(s)	<input type="checkbox"/> CD, Number of CD(s)	3. Drawing Transmittal Letter
<input type="checkbox"/> Response to Missing Parts/Incomplete Application	Remarks	
<input type="checkbox"/> Response to Missing Parts under 37 CFR 1.52 or 1.53		

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT	
Firm or Individual name	Law Office of Kenneth C. Brooks
Signature	
Date	November 27, 2001

CERTIFICATE OF MAILING			
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SEP 13 2006

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

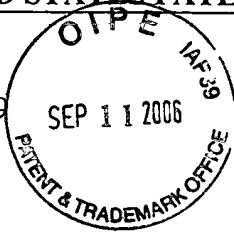
Applicants: Mak, et al

Application No.: 09/885,609

Filed: 6/20/2001

Title: System and Method to Form a  
Composite Film Stack Utilizing  
Sequential Deposition Techniques

Attorney Docket No.: 5351/AMI-00-12



Group Art Unit:  
2812

Examiner:  
Unknown

Assistant Commissioner for Patents  
Washington, D.C. 20231

DRAWING TRANSMITTAL LETTER

Sir:

Enclosed herewith please find:

- ( ) \_\_\_\_\_ sheets of redlined drawing(s) which indicate proposed changes to the drawing(s). Upon approval of these proposed changes, formal drawing(s) will be submitted.
- ( ) \_\_\_\_\_ sheets of corrected formal drawing(s), as required by the Notice of Patent Drawings Objection (PTO-948) which accompanied the Office Action dated \_\_\_\_\_.
- ( ) \_\_\_\_\_ sheets of corrected formal drawing(s), as required by the Notice of Patent Drawing(s) Objection (PTO-948) and approved in the Notice of Allowability dated \_\_\_\_\_.
- (✓) 6 \_\_\_\_\_ sheets of formal drawings. Please substitute these formal drawings for the informal drawings originally filed.

Examiner's approval of the entry of these drawings is respectfully requested. No new matter has been added.

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Date of Deposit: November 27, 2001

Typed Name: Jennifer Bonham

Signature: [Signature]

Respectfully Submitted,

By [Signature]  
Kenneth C. Brooks

Attorney/Agent for Applicant(s)  
Reg. No. 38,393

Date: November 27, 2001

SEP 13 2006

Telephone No.: 512 527-0104

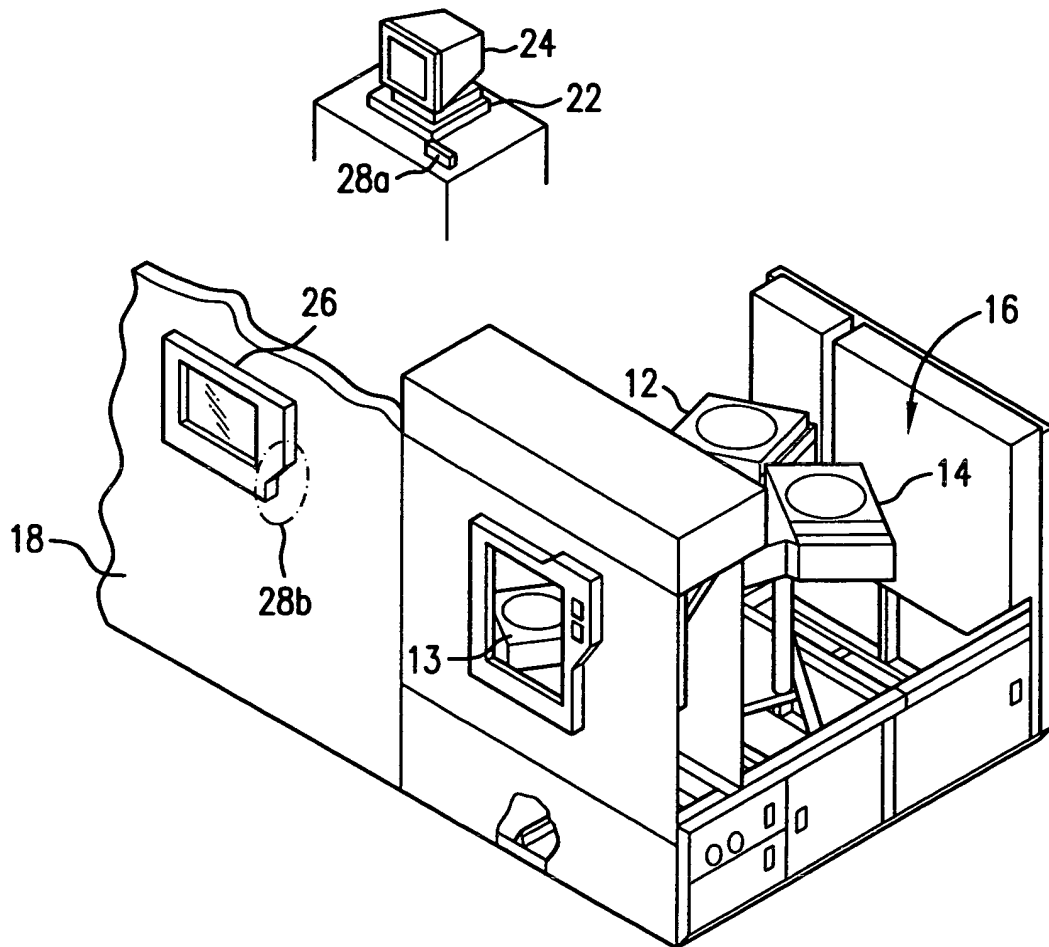


FIG. 1

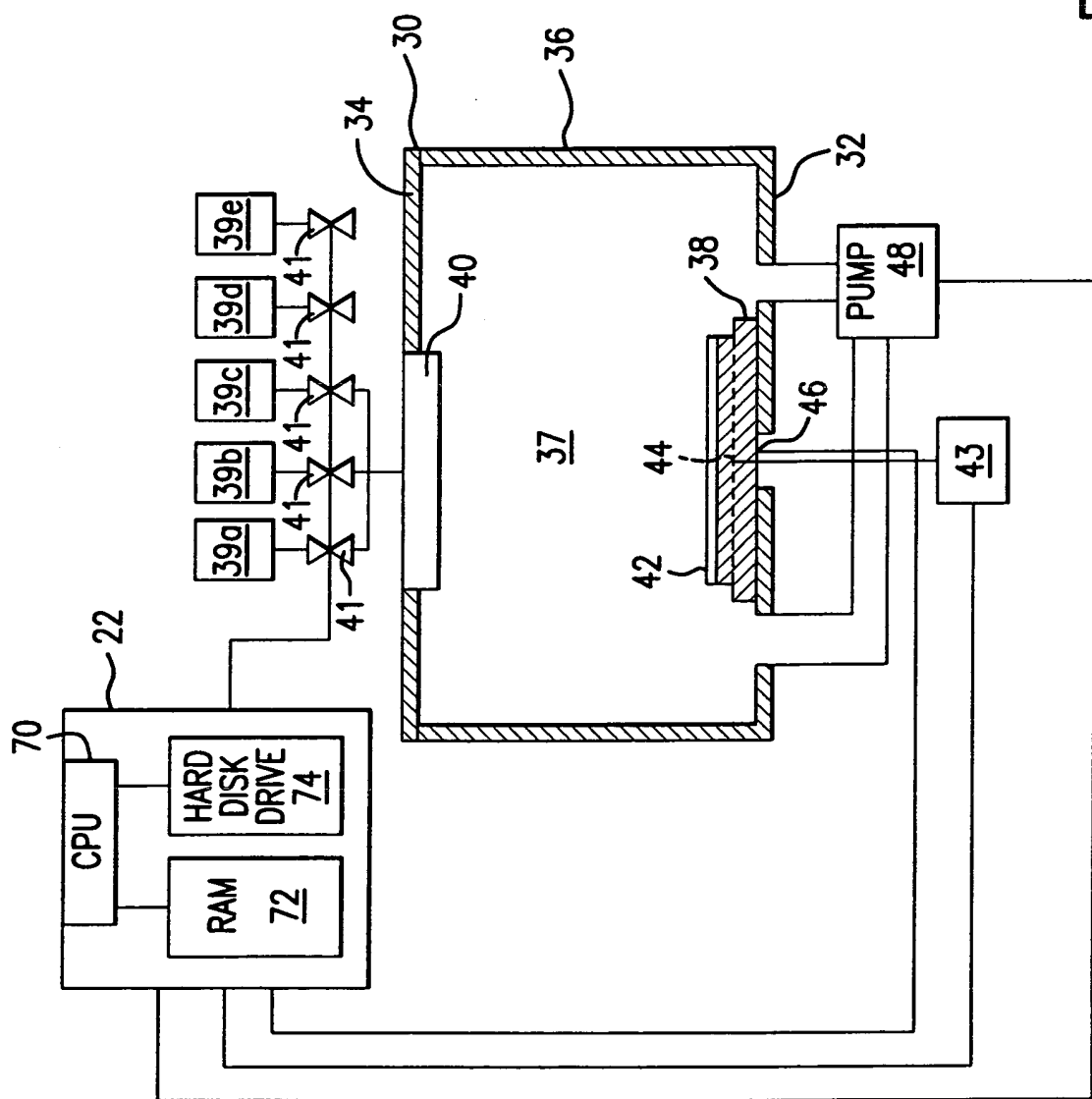


FIG. 2

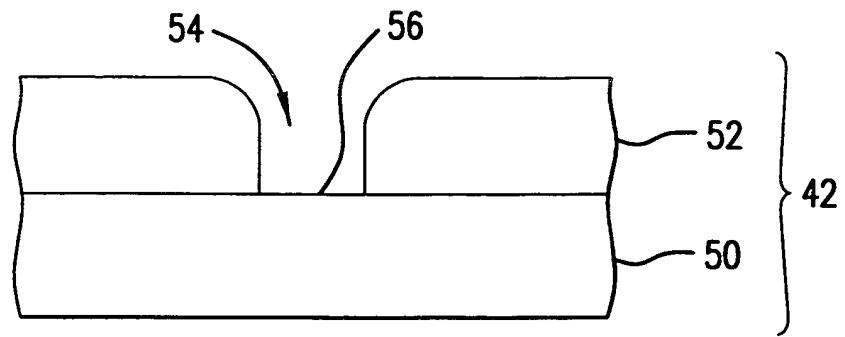


FIG. 3

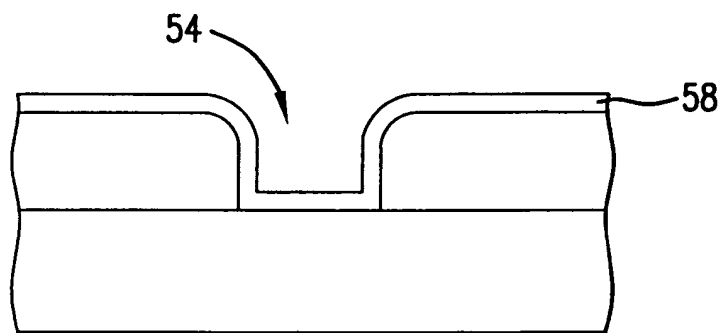


FIG. 4

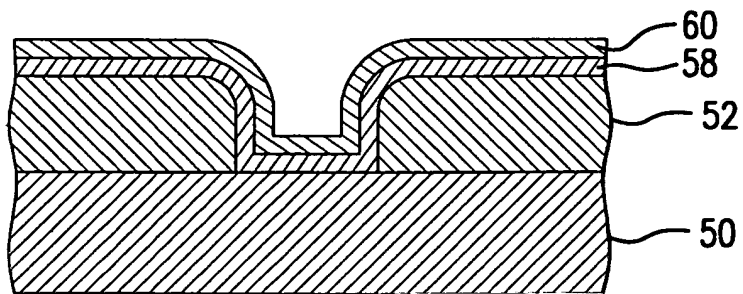


FIG. 5

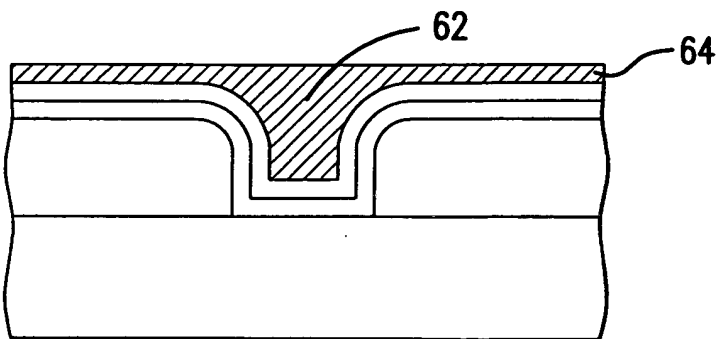


FIG. 6



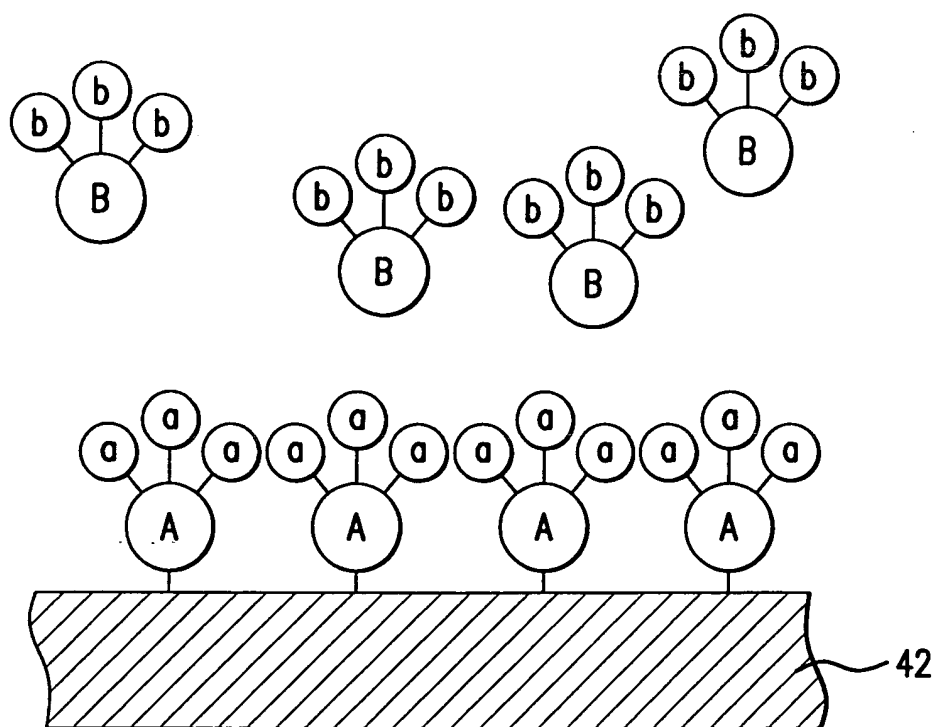


FIG. 7

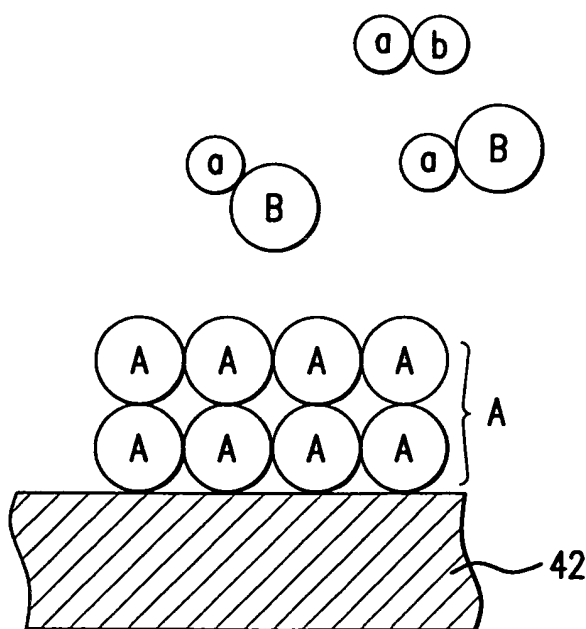


FIG. 8

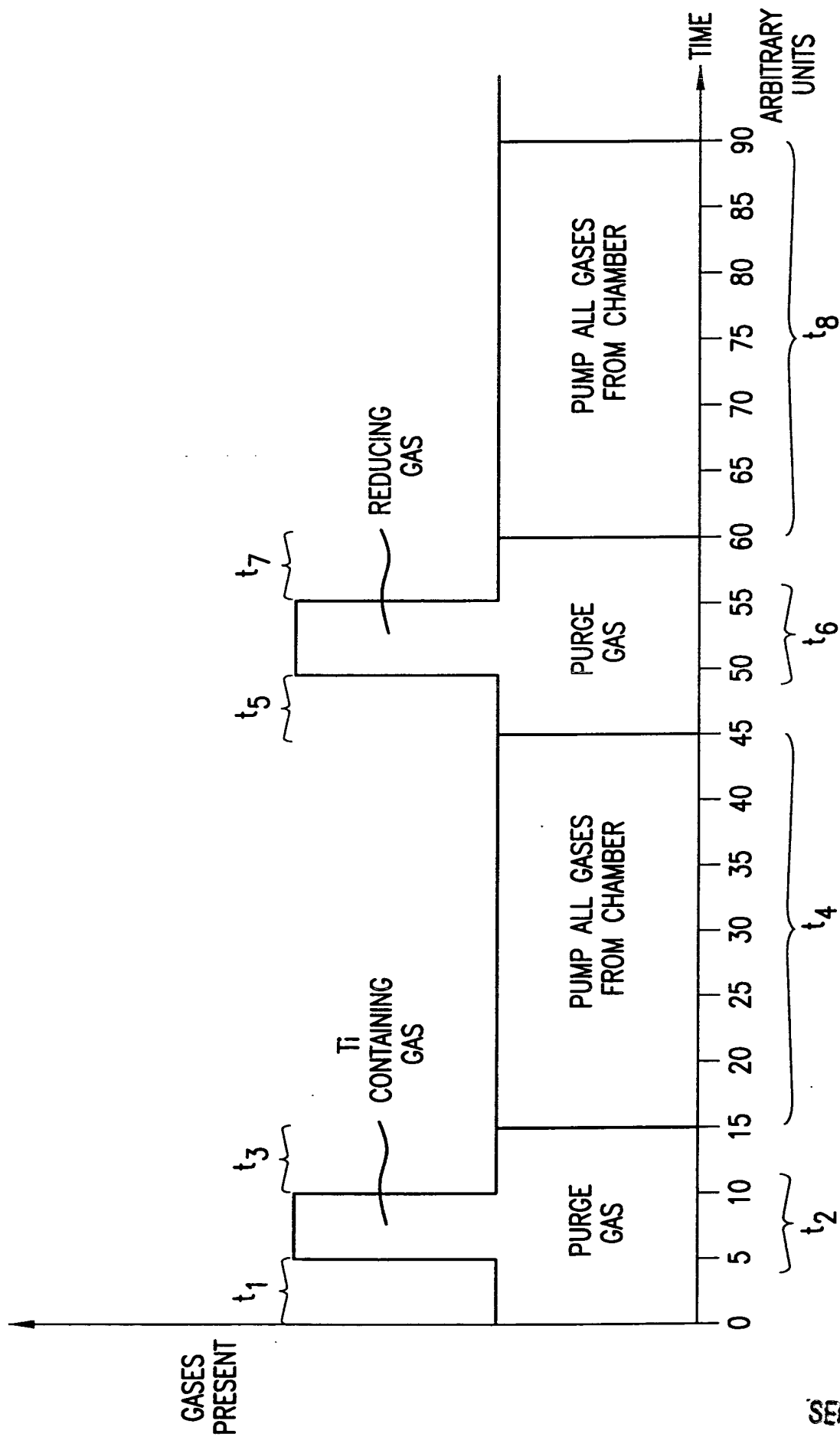


FIG. 9

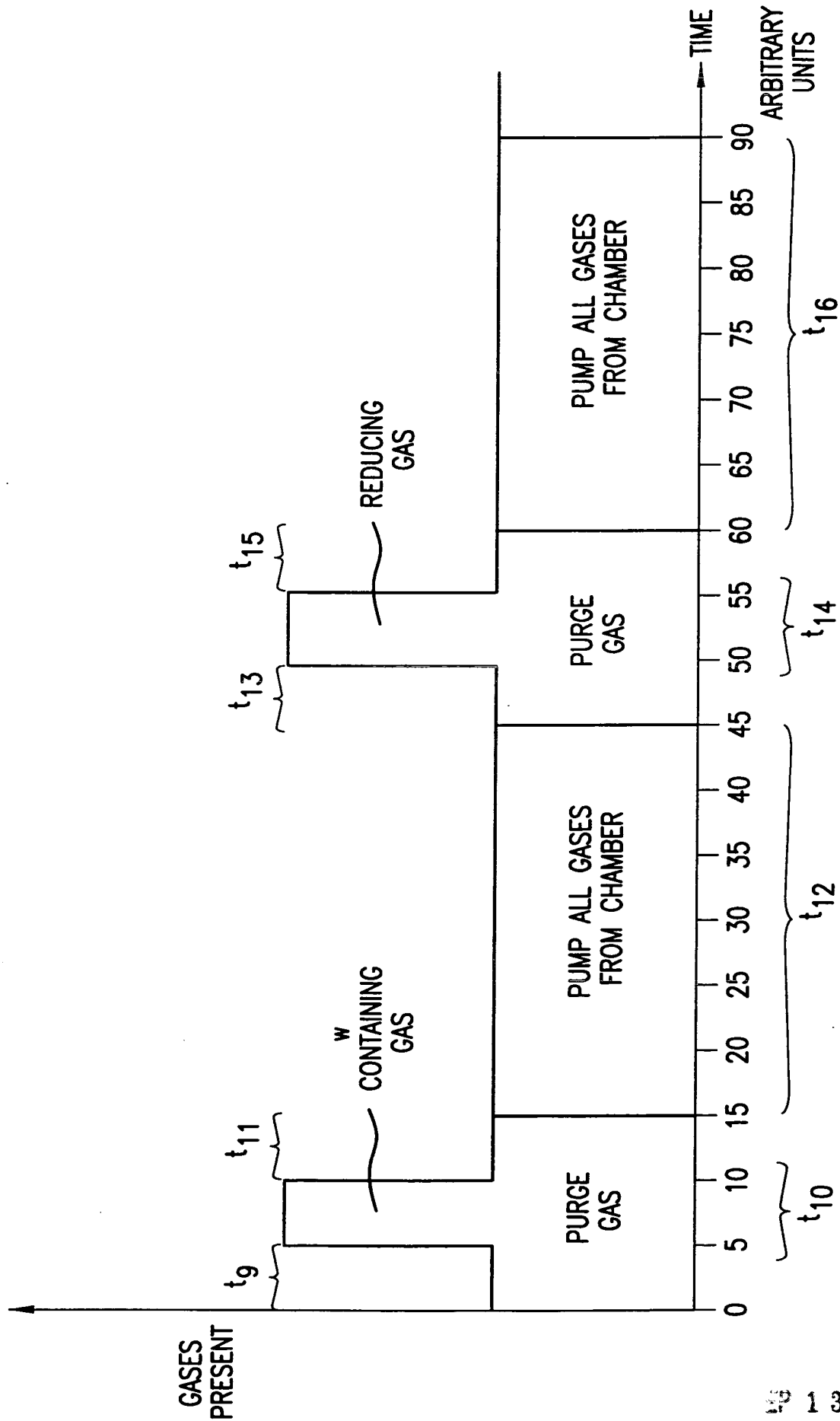
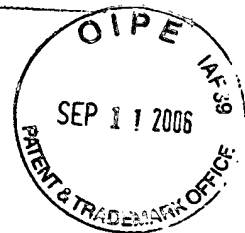


FIG. 10

BOX PATENT APPLICATION  
Commissioner for Patents  
Washington, D.C. 20231



Applicant: Mak et al.  
Assignee: Applied Materials, Inc.  
Title: SYSTEM AND METHOD TO FORM A COMPOSITE FILM STACK UTILIZING  
SEQUENTIAL DEPOSITION TECHNIQUES

Serial No. 09/885,609 Filed: 06/20/01

Attorney Docket No.: 5351/AMI-00-12

- X Transmittal Form
- X Letter to Chief Draftsperson
- X Six sheets of formal drawings
- X Return Receipt postcard to Kenneth C. Brooks
- X Return Receipt postcard to Applied Materials

Dated: November 27, 2001

BOX PATENT APPLICATION  
Commissioner for Patents  
Washington, D.C. 20231



Applicant: Mak et al.  
Assignee: Applied Materials, Inc.  
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